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AUTHOR Fairgrieve, Susan; Walton, Nancy
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ABSTRACT

This report describes a program that used both critical and creative thinking skills to enhance the educational process in language arts. The targeted population consisted of fourth- and seventh-grade students in two growing, middle-class communities located in northern Illinois. The lack of higher-order thinking skills was documented through teacher-made inventories, teacher-made content area tests, and a thinking skills rubric. Analysis of probable cause data revealed that students lacked skills related to higher-order thinking, lacked the ability to explain problem-solving strategies, and lacked the ability to transfer knowledge to new situations. Educators consistently fail to provide explicit instruction in higher-order thinking skills and resist change in teaching practices and curriculum to include the needed instruction. Reviews of curricula and instructional strategies revealed a curricular under-emphasis on information pertaining to higher-order thinking skills. A review of solution strategies combined with an analysis of the problem setting resulted in the selection of one intervention--an implementation of a teacher-constructed program with an increased emphasis on higher-order thinking processes. Post intervention data indicated an increase in student use of higher-order thinking skills. (Contains 30 references, and 4 tables and 2 figures of data. Appendixes present assessment instruments, rubrics, and 10 sample lessons concerning brainstorming, predicting, compare/contrast, questioning, cause/effect, sequencing, problem-solving, and inferring.) (Author/RS)

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IMPROVING HIGHER ORDER THINKING SKILLS IN LANGUAGE ARTS

by

*Susan Fairgrieve
and
*Nancy Walton

Submitted in partial fulfillment of the requirements for the degree of Master's of Arts in Teaching and Leadership

Saint Xavier University & IRI/Skylight
Field-Based Master's Program

*Teacher
Lena Elementary
Lena, Illinois

*Teacher
Harlem Junior High
Loves Park, Illinois

Action Research Project
Site: Winnebago, Illinois
Submitted: May 1996

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SIGNATURE PAGE

This project was approved by

Connie Parker — Sara Koch

Advisor

Advisor

Terry Stirling, Ph.D.

Dean, School of Education

Abstract

Authors: Susan Fairgrieve
Nancy Walton

Site: Winnebago

Date: May, 1996

Title: Improving Higher Order Thinking Skills in Language Arts

This report describes a program, utilizing both critical and creative thinking skills, to enhance the educational process in language arts. The targeted population consisted of fourth and seventh grade students in two growing, middle class communities, located in northern Illinois. The lack of higher order thinking skills was documented through teacher-made inventories, teacher-made content area tests, and a thinking skills rubric.

Analysis of probable cause data revealed that students lacked skills related to higher order thinking, lacked the ability to explain problem-solving strategies, and lacked the ability to transfer knowledge to new situations. Educators consistently fail to provide explicit instruction in higher order thinking skills and resist change in teaching practices and curriculum to include the needed instruction. Reviews of curricula and instructional strategies revealed a curricular under-emphasis on information pertaining to higher order thinking skills.

A review of solution strategies suggested by knowledgeable others, combined with an analysis of the problem setting, resulted in the selection of one intervention: an implementation of a teacher-constructed program with an increased emphasis on higher order thinking processes.

Post intervention data indicated an increase in student use of higher order thinking skills.

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Chapter 1

PROBLEM STATEMENT AND CONTEXT

General Statement of Problem

The students of the targeted fourth and seventh grade classes do not use higher order thinking skills. Evidence for the existence of the problem includes teacher journal entries, student journal entries, and teacher-made assessments.

Immediate Problem Context School A

The setting for this research is a rural setting in a midwestern state. School A is part of a Unit district, grades PK-12 with a total district population of 1,096.

School A is an elementary school, grades 2-5, with a student enrollment of 326. The racial-ethnic background of the school consists of 98.8 percent White, non-Hispanic, 0.3 percent Black, non-Hispanic, 0.3 percent Hispanic, 0.6 percent Asian/Pacific Islander, and zero percent Native American.

Sixteen point six percent of the student population in this elementary school come from low income households. Students are considered low-income if their families are receiving public aid, if they live in institutions for neglected or delinquent children, if they reside in foster

homes supported with public funds, or if their families are eligible to receive free or reduced-price lunches.

School A has a 96.8 percent attendance rate. Student mobility is 8.5 percent. There are no chronic truants.

The school district employs a total of 66 staff members, of whom 100 percent are White. Male staff members comprise 30.5 percent and female staff members comprise 69.5 percent. The average teaching experience of the staff is 13.9 years. The percentage of teachers with a Bachelor Degree is 81.7 and of teachers with a Master Degree and above is 18.3.

School A employs one principal, one assistant principal, one secretary, one part-time social worker for the district, one nurse for the district, one part-time psychologist providing services through a county cooperative, two special education teachers with full-time aides, 16 classroom teachers, one physical education teacher, one music teacher, one chapter I/gifted teacher, and two custodians.

Time devoted to the teaching of core subjects per 5-day school week is: 45 minutes for mathematics, 30 minutes for science, 160 minutes for English, and 30 minutes for social studies. Other subjects in which students participate are physical education 2-3 times per week and music 2-3 times per week. A special education program is in effect. Tutoring is offered in science and social

studies for special education students. Students are homogeneously grouped in reading and mathematics. There are two regular classrooms that are self-contained in which the students receive instruction for all subjects.

The average class size for School A is 24 students per class. The pupil-teacher ratio for elementary education is 18.7:1. The pupil-administrator ratio is 313.1:1.

It is important to review other information pertinent to this study. A total of 100 percent of the parents/guardians of the students in School A made at least one teacher contact during the school year (State School Report Card, 1994).

Because of a recent building trend in this community, there has been an influx of students entering the district's school system; consequently, a new, larger elementary school is being constructed. A referendum was successfully passed to build the new school. Grades PK-1 are now housed in an elementary school in an adjoining community. This building is slated to close once the new building is completed. Grades PK-5 will be housed in the new school. Voters in the nearby community soundly defeated the referendum for their voting precinct because they wanted their school to remain open.

The changes in the school district have created tension between the two communities. For years, 90 percent of the student population who attend this school have been

bused from the larger community to the smaller community to allow the elementary school to remain open at the request of the town government. Because of the school closing, the inhabitants of the smaller community feel that their town will eventually cease to exist.

Staff morale has been negatively impacted by a small faction within the faculty. These individuals have created dissension within the community through clandestine opposition to the new principal's decisions and programs. Tensions run high among all factions. The school district has been working hard to bring the dissension to an end.

Immediate Problem Context School B

School B is located in an urban setting. It is part of a Unit district, grades PK-12. The total district population is 6,306 students.

School B is a junior high school, grades 7-9, with a student enrollment of 1,532. The racial-ethnic background of the school consists of 92 percent White, non-Hispanic, 3.2 percent Black, non-Hispanic, 3.5 percent Hispanic, 1.0 percent Asian/Pacific Islander, and 0.3 percent Native American.

Fourteen percent of the student population in this junior high school are from low income households. Students are considered low-income if their families are receiving public aid, if they live in institutions for

neglected or delinquent children, if they reside in foster homes supported with public funds, or if their families are eligible to receive free or reduced-price lunches.

School B has a 91.9 percent attendance rate, and a student mobility rate of 16.1 percent. Chronic truancy comprises 1.5 percent of the school population, with the number of chronic truants at 23.

The school district employs a total of 348 staff members of which 99.7 percent are White and 0.3 percent are Asian/Pacific Islander. Male staff members comprise 27.4 percent and female staff members comprise 72.6 percent. The average teaching experience of the staff is 17.3 years. The percentage of teachers with a Bachelor Degree is 49.4 and the percentage of teachers with a Master Degree and above is 50.6.

School B employs 157 people. Ninety-two are certified staff and 65 are non-certified staff. There is one principal, one associate principal, and two assistant principals. Support staff include one psychologist, one intern psychologist, one social worker, one intern social worker, one nurse, and three counselors.

Time devoted to the teaching of core subjects per 5-day school week is 46 minutes for mathematics, 46 minutes for science, 92 minutes for English, and 46 minutes for social studies. Physical education is required daily. Health is required for one semester. Electives offered

on a daily basis are music, home economics, and technical education. A special education program is in effect. Inclusion is implemented in one section of all core subjects. Students are homogeneously grouped in English, science, and mathematics.

The average class size for School B is 25 students per class. The pupil-teacher ratio for secondary education is 22.9:1. The pupil-administrator ratio is 300.3:1.

It is important to review other information pertinent to this study. A total of 42.6 percent of the parents/guardians of the students in School B made at least one teacher contact during the school year (State School Report Card, 1994).

New subdivisions are under construction causing a growth in school population. Because of a recent lawsuit in a nearby school district, there has been an influx of students entering the school system. Portable classrooms have been utilized to accommodate the growing school population. A technological academy, housed in a separate building, has been instituted. Three hundred students attend this academy four hours in the morning or four hours in the afternoon and are bused from School B. This helps alleviate some of the overcrowded conditions.

With the influx of students, racial tensions have escalated, gang activities have risen, and drug-related behavior incidences have become more prevalent.

Consequently, the school discipline code is in question. It was revised three years ago; but, because it is not producing the desired results, it has been returned to a committee for further study.

Another factor placing School B in a state of flux is the loss of both the principal and the associate principal. With both top positions vacant, there will be new leadership which may be heading in an unknown direction. The goals and expectations could be much different than those of the previous regime. In addition to the loss of leadership, the school is changing from a traditional classroom teaching situation to families or teams. The staff has had no training and relatively little direction for making the transition. There is much trepidation and anxiety for many in making this change. There is a great deal of support from the three counselors, the social workers, the psychologist, the diagnostician, and the bilingual coordinator.

The Surrounding Community

The district in which School A is located is considered a medium-size Unit district because the total student population is 1,096. There are two elementary schools, one of which contains grades PK-1 and the other of which contains grades 2-5. The junior high school services grades 6-8, and the high school contains grades 9-12. The elementary school, containing grades PK-1, is the only

school housed in a nearby, smaller community. The rest of the schools are all in the same larger community.

The operating expenditure for School A's district is $3,677 per pupil.

One superintendent oversees all administrative services. There are three principals, one for each of the junior high and high school buildings and one principal in charge of the two elementary buildings. There is an assistant principal to aid in the operation of the elementary buildings.

The population of this community is approximately 2,800 people. Most of the people must travel to the surrounding larger communities for employment. This community is a manufacturing community with high employment concentrations in machining, hardware, transportation equipment industries, insurance, and agricultural products.

Figure 1

Percentage of People in Employment Categories

The blue collar workers of this community reflect the

technical needs of these industries. Of the six major employers in the community, only two have union affiliations. The county where this community is located has 2,010 farms. Farm lands are 74 percent under cultivation. The percentage of the unemployed civilian labor force is 5.2 percent. The per capita income is $13,236. The farms in this county have the highest per capita income in this state. The median household income is $26,492.

The percentage of parents with a high school diploma or higher is 81.6 percent and the percentage of those attaining a bachelor degree or higher is 8.1 percent.

This community is serviced by two part-time police officers and a volunteer fire department. The county supplements the police department with patrol duty. There is a mayor/council form of government.

There are six major cities located within an eight hour drive. There are two full service hospitals within a 50 mile radius of this community. The area is serviced by one doctor's office and one dental office. There is one nursing home. One weekly newspaper and one television station sponsored by the school district is found in this rural setting. The area is serviced by cable television. The nearest major airport is 50 miles away. The town is located near a major state highway. There are two motor freight carriers in the surrounding area. One state park

with a man-made lake is found nearby. Four parks are located within the township, one containing the municipal swimming pool. There is access to one golf course. A strong religious background is indicated with six churches representing several faiths. There are two financial institutions located in this community. Land and programs are obtainable to promote the future growth of commercial, residential, and agricultural developments. Affordable housing is available. Access to shopping is available in nearby communities. A number of advanced education facilities including two junior colleges, a business college, a liberal arts college, a college of medicine, a college of nursing, and a technology center are available within and/or nearby the area.

The business community takes an active interest in the school system. They invest time, money, and manpower to ensure that the students meet the requirements of the business world. The entire community is involved in the school system donating time, money, and talent.

School B is located in a large Unit district with a total student population of 6,036. There are eight elementary schools, one junior high school, and one high school. The technology academy is housed in a separate school.

The operating expenditure for School B's district is $4,798 per pupil.

The district is run by one superintentent and one assistant superintendent who coordinates education for the district. The junior high school has one principal, one associate principal, and two assistant principals.

The population of this community is approximately 15,462 people. Many people must travel to the adjoining metropolitan area for employment. This community is a manufacturing community with high employment concentrations in machining, metalworking, and transportation equipment industries.

Figure 2

Percentage of People in Employment Categories

The blue collar workers of the community reflect the technical needs of these industries. Approximately 17 percent of the labor force and only four of its 16 largest manufacturers are organized under collective bargaining agreements. The percentage of the unemployed civilian labor force is 5.2 percent. The per capita income is $14,109. The median household income is $28,282.

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The percentage of parents with a high school diploma or higher is 78.3 percent and the percentage of those attaining a bachelor degree or higher is 10.7 percent.

This community is serviced by a full-time police force and a volunteer fire department. There is a mayor/council form of city government.

There are six major cities located within an eight hour drive. There are three full service hospitals including two regional trauma centers in the metropolitan area. Numerous dental and health clinics are accessible to the area. One daily newspaper, one weekly newspaper, ten radio stations, and four television stations service the metropolitan area. The area is serviced by cable television. There is one major airport. This community has access to two interstate highways and five state highways. There are 37 motor freight carriers in the surrounding community. There are 165 parks located in the metropolitan area. There is access to 12 swimming pools and 13 golf courses. People of all faiths are represented with 241 churches and synagogues found in the area. There are 12 financial institutions located in the surrounding community. Land and programs are obtainable to promote the future growth of industrial, commercial, and residential development. Affordable housing is available. One major shopping center is located in this city with access to 12 more in the neighboring community.

A number of advanced education facilities including a junior college, a business college, a liberal arts college, a college of medicine, a college of nursing, and a technology center are available within and nearby the area.

The business community takes an active interest in the school system. They invest time, money, and manpower to ensure that students meet the requirements of the business world.

Regional and National Context of Problem

Students do not intuitively learn how to use higher order thinking skills. Time spent developing thinking skills is advocated more and more by researchers and theorists. By developing these skills, students will become better creative and critical thinkers.

The knowledge students acquire in school should go beyond the confines of the classroom and extend into everyday life. Educators assume that students will automatically transfer learned knowledge to new problem-solving contexts. Transfer is not automatic because students often fail to apply knowledge and skills learned in one situation to other situations (Perkins and Salomon, 1988).

Of national concern, is the fact that students need to develop higher order thinking skills to fulfill the demand by today's employers. Programs must show students

how their learning transfers directly to problems in the workplace and real-life situations (North Central Regional Educational Laboratory, 1995). Students need to create meaningful connections between what they already know and what they are attempting to learn. The new information must take on personal relevance for each student. Many times students perform tasks without wondering why they are doing what they are doing. They often are unable to explain their strategies for solving problems when performing those tasks. "If we wish to develop intelligent behavior as a significant outcome of education, instructional strategies purposefully intended to develop children's metacognitive abilities must be infused into our teaching methods, staff development, and supervisory processes" (Costa, 1984, p. 58).

For years, educators have assumed that students develop higher order thinking skills as they grow older and have more school experiences. While this may be partially true, many students do not develop these skills unless they receive direct instruction in higher order thinking skills (Weinstein, Ridley, Dahl, & Weber, 1989).

The enhancement of higher order thinking abilities should be a major objective of the educational process. Many students graduating from high school do not have the capabilities to apply problem-solving techniques to real-world problems. They are not prepared to do the kind of

thinking that is required by college experiences or job experiences. There is an increasing interest among educators advocating the teaching of higher order thinking skills. According to Beyer (1983), the goal of teaching thinking skills is to equip students with the thinking tools they need in order to learn and to transfer this knowledge to real-life situations.

Chapter 2

PROBLEM EVIDENCE AND PROBABLE CAUSE

Problem Evidence

In order to document the lack of higher order thinking skills, the researchers developed a pre-assessment inventory (Appendix A) and a student rubric (Appendix C). These forms were given to 19 fourth grade students and 28 seventh grade students.

The inventory attempted to assess the level of higher order thinking skills in the students. In order to extract more elaborate responses other than yes/no answers, the researchers chose an imaginative situation using questions based on higher order thinking skills. Elicited responses attempted to produce the following student behaviors: flexibility in thinking, ingenuity, originality, and insight. Students were to make use of all of their senses in responding to the inventory. The questions were used to show the efficacy of the students as thinkers.

Forty-seven students in the two grades were administered the inventory and rubric. A summary of the students' performance on the generated assessment inventory is presented in table one.

Table 1

Standards of Student Performance

QUESTIONS	EXEMPLARY	ADEQUATE	INADEQUATE
Describe Surroundings	14	25	0
Previous Use	6	24	17
Feelings at being Posted Around	10	19	19
Speculate About Existing Activities	10	18	11
Predict Plans for the Future	12	24	11

The results of the inventory indicate that of the five questions students completed, 50 percent of the students utilized adequate thinking skills. Approximately 25 percent of the students were judged as utilizing inadequate thinking skills. This suggests that 75 percent of students fall below the researchers' expectations and indicates a marked need for instruction in higher order thinking skills. A further analysis of the inventory suggests students were best at speculating about future plans and describing existing conditions. The most difficulty was found in describing feelings and using regressive thinking.

Table two summarizes the results of the student rubric administered as a self-assessment of higher order thinking skills.

Table 2

Student Self-assessment

STATEMENTS	NONE OF THE TIME	SOME OF THE TIME	MOST OF THE TIME	ALL OF THE TIME
Clear Ideas	1	24	19	4
New Suggestions	3	24	16	4
Flow to Begin	4	19	21	3
Thinking Through	3	19	22	3
Many Answers	1	16	19	13

The results suggest that 50 percent of the self-reporting students are not comfortable in their use of higher order thinking skills. This seems to indicate that students may not have the ability to recognize thinking skills, do not have the confidence to implement thinking skills, or do not have the insight to measure their own thinking skills. A discrepancy between student self-reporting and the researchers' external observations indicates that 90 percent of students sustain inappropriate levels of higher order thinking skills or demonstrate a lack of awareness of higher order thinking skills. Analyzing further, nearly 33 percent of the students are more aware that problems may have more than one correct solution.

Data analyzed in tables one and two suggest that students lack the use of higher order thinking skills. Fifty percent of the students feel they have some concept

of the skills needed for higher order thinking and the confidence to implement those skills. A discrepancy was noted between researchers' expectations and students' perspectives of their own thinking skills. This clearly shows a need for the improvement of higher order thinking skills.

Probable Causes

Most students do not recognize higher order thinking skills. An inventory and rubric given to the fourth and seventh grade students show that many questions were inadequately answered. Some students did not know where to begin answering the questions. Many had confused looks on their faces. Some students questioned the researcher as to the type of answers they should write. All of these actions demonstrate a lack of knowledge of higher order thinking skills.

The literature suggests several underlying causes for the lack of higher order thinking skills in language arts. According to Costa (1984), students have no idea of what they are doing when performing a task and often are unable to explain their strategies for solving problems. They fail to question why they are doing an assignment and just follow instructions by rote.

"Students do not transfer the knowledge to problem-solving contexts where they have to think about new situations" (Perkins & Salomon, 1988, p. 23). Educators

assume that transfer takes place once knowledge is gained or as students mature, and that they will automatically be able to use their skills to solve problems in all types of situations. According to Perkins and Salomon (1988), educators assume that transfer takes care of itself.

Texts and teachers fail to provide explicit instruction in the implementation of thinking skills (Beyer, 1983). Teaching thinking skills is often passed over because most educators do not consider these skills as part of the basic curriculum. They feel that this is just one more activity to add to an already overloaded schedule (Bereiter, 1984).

Because of a lack of emphasis on higher level skills in commercial instructional materials, educators feel they must develop their own materials. This leads many educators to believe that the task of developing those materials is formidable, expensive, and time-consuming. Educators do not want to teach thinking skills because they fear the loss of basal texts, which will require changes in teaching practices and curriculum. Due to a reluctance to change, educators rely on the old popular method of asking recall questions rather than questions that require students to think (Allen, Wright, & Laminack, 1988; Casey & Tucker, 1994; Gall, 1984).

Since there is no standardized method of measuring higher order thinking skills, educators are reluctant to

redesign tests provided by textbook companies. "The introduction of more qualitative assessment techniques would require a shift from paper-and-pencil tests to a broader view of assessment as a combination of both qualitative and quantitative techniques" (Burke, 1994, p. 18). Alternative assessments give a more rounded picture of a student's ability to demonstrate thinking skills.

Probable causes for improving higher order thinking skills in language arts include: inability to recognize higher order thinking skills, inability to explain problem-solving strategies, lack of metacognitive transfer to new situations, failure by tests and teachers to provide explicit instruction of higher order thinking skills, resistance to change in teaching practices and curricula, and lack of standardized assessment techniques.

Chapter 3

THE SOLUTION STRATEGY

Review of the Literature

Traditionally, instruction has focused on memorizing, has been teacher-dominated, has used traditional resources, and has based assessment on quantitative data. The curriculum is designed to enable students to absorb information closely guided by an external, inflexible time schedule. The end result is to find out whether students can answer the teacher's or textbook's questions (Caine & Caine, 1995). The literature suggests that this traditional model of learning is being challenged. Many solutions are being utilized to improve higher order thinking skills in students.

According to Costa and Marzano (1987), educators provide so much information that students can comply to the given directions without having to think for themselves. Too many times educators tell students what to do, when to do it, and how to behave when they do it. Educators direct students to think hard, but students may not know the vocabulary or may not know how to do that particular skill. Since learning is mostly language-oriented, educators should use specific wording that shows students

how to perform these thinking skills. Educators must teach students what goes on inside their heads.

Costa and Marzano (1987) believe that students who describe their own thinking internalize the thinking process. Educators, who share their own thinking by modelling metacognitive processes, give students an excellent opportunity to see how thinking works. They externalize the inner dialogue that leads them to a problem solution; thus, modelling the process of thinking for the student.

Research is inconclusive about the best way to teach thinking skills. "For every set of studies showing that questioning patterns improve student thinking, there is another set that suggests that they have no significant effect" (Beyer, 1983, p. 45).

The U. S. Department of Education (1988), through the office of Educational Research and Improvement, states there is a controversy between teaching thinking skills as an independent course or integrating thinking skills into established courses. Separate teaching of thinking skills may not enable transfer to the content area or to real-life situations. If thinking skills are taught separately, the same efforts must be carried out across the curriculum. If thinking skills are taught in the content areas, educators must demonstrate extensive knowledge of their own subject and how it is different

from others. A link between content areas must be made across the curriculum. Demonstration of transfer has not been widely successful across the content areas, but the scheduling of an extra course is eliminated. The solution, then, is to combine methods to provide a framework for instruction.

Research suggests that thinking skills should be directly taught but integrated into the existing curriculum. It should also be done in a systematic way and be developed over a period of time (Beyer, 1988).

Techniques for direct teaching of thinking skills, as described by Jackson (1986), include a five step plan. These five steps consist of introduction, explanation, demonstration, application, and reflection upon the skills taught. Jackson further suggests that direct instruction is also helpful. It can be structured, and at the same time, flexible. "Select a skill, identify its main attributes, introduce it at a time in the curriculum when the skill is needed and therefore meaningful, develop guided and independent practice lessons, and intersperse these practices throughout the year" (Beyer, 1984, p. 20).

Transfer is integral to the expectations of what education hopes to achieve. According to Perkins and Salomon (1988), transfer is something that is learned in one context which helps in another context. Transfer does not take care of itself and traditional schooling pays

little attention to the problem. Educators need to teach for transfer. Perkins and Salomon further state that transfer goes beyond ordinary learning in that the skill has to travel to a new context. Derry (1988) believes that strategy training should develop a well-structured knowledge base. If this is the primary aim of a good education, students can use the knowledge gained from good strategy teaching to cope with various situations they will encounter in their lives.

Although texts claim to require students to use selected thinking skills, they rarely provide explicit instruction in what the skills are or how to execute them (Beyer, 1983). Much has been written on the need for students to perform higher order thinking skills. The teaching of these skills fails because the instruction is inadequate (Rosenshine & Meister, 1992). Martin (1989) believes that many thinking skills programs should have some form of teacher training; however, most of that training has been done in the form of inservice training. Educators do not get enough practice in the teaching of these skills. Martin further states that formal teacher education in the area has been neglected. Many experienced educators, who have been implementing thinking skills programs, retire. Replacement teachers enter the work force unskilled in teaching higher order thinking.

According to Bereiter (1984), textbooks list a few rules, provide examples, and offer exercises in which

students should apply the rules, leading educators to believe that textbooks are providing teaching strategies for thinking skills. This allows textbook sales to soar. Bereiter also states that thinking skill instruction is just one more thing for which educators are held accountable; therefore, thinking skills activities are often used as enrichment rather than as an instructional program. Since accountability plays such an important role in evaluation, educators are fearful of experimenting with new teaching methods. Curriculum is largely textbook based and recall of information is required of the students rather than thinking independently (Gall, 1984). Mastery of thinking operations requires repeated instruction and considerable time, time an educator is unwilling to take away from traditional instruction (Beyer, 1988).

Alternative methods of assessment should be considered. Performance assessments are much better ways to assess complex thinking and problem-solving skills; however, they are not as efficient in determining whether students have acquired basic facts or concepts. Balancing the approach to assessment can give a broader measure of a student's understanding. Alternative assessments stress the importance of looking at the processes in addition to the products (Herman, Aschbacher, & Winters, 1992). Emphasizing right and wrong, as traditional assessment does, is no longer feasible. The learner and the teacher should be

connected by other alternatives which provide nonjudgmental feedback, teacher monitoring and observation, and activities that assess while learning is still occurring (Brooks & Brooks, 1993).

Educators have several obstacles to overcome including: an inadequate knowledge base for teaching thinking skills, the expense of academic instruction to teach these skills, lack of time and available materials, integration of thinking skills into everyday life, provision for teacher training, and implementation of the most practical method of evaluation for higher order thinking.

Project Outcomes and Solution Components

Solutions suggested by the professional literature, combined with an analysis of the site, resulted in the formulation of the following terminal objective.

> As a result of increased instructional emphasis on higher order thinking processes, during the period of September 1995 to December 1995, the fourth and seventh grade students from the targeted classes will increase their ability to use higher order thinking skills in language arts, as measured by student rubrics and teacher-constructed inventories and tests.

In order to accomplish the terminal objective, the following processes are necessary:

1. Acquire or create materials that foster higher order thinking in language arts.

2. Develop a series of learning activities that address higher order thinking in language arts.

3. Facilitate students to generate materials that reflect higher order thinking processes.

Action Plan for the Intervention

During the time span designated for the intervention, the targeted fourth and seventh grade students will receive instruction in higher order thinking skills in language arts. The intervention will take place in the researchers' individual classrooms. The instruction will be incorporated into each researcher's routine and/or schedule, twice a week, for a 30-40 minute time period. The teacher-constructed program will use already developed materials taken from various sources. Before the students begin each new activity, the researchers will introduce the specific skill or skills to be studied for those two weeks. The researchers will then carry out the following action plan.

I. Summer 1995

A. Create materials

1. Pre-assessment inventory (Appendix A)

2. Post-assessment inventory (Appendix B)

3. Student rubric (Appendix C)

B. Collect materials

1. Lesson activities

2. Graphic organizers

II. Beginning of school-September 15, 1995

A. Give pre-assessment inventory

B. Give student rubric as self-assessment

C. Explain intervention to the students

D. Introduce thinking about thinking

1. Explain thinking logs

2. Make and/or organize thinking logs

III. September 18-September 29, 1995

A. Teacher modelling

B. Introduce skill of brainstorming

C. Brainstorming lesson (Appendix D)

D. Student processing of brainstorming to be used with a short story to describe character traits of the characters

E. Student thinking log (Appendix E)

IV. October 2-October 13, 1995

A. Introduce skill of predicting

B. Predicting lesson (Appendix F)

C. Student processing of predicting to be used before and during a story or novel to show what will happen, how characters will feel, or consequences of options chosen

D. Introduce skill of compare/contrast

E. Compare/contrast lesson (Appendix G)

F. Venn diagram (Appendix H)

G. Student processing of compare/contrast to be used while comparing characters, situations, and ideas to analyze, classify, or define

H. Student thinking log

V. October 16-October 27, 1995

A. Introduce skill of questioning

B. Questioning lesson (Appendix I)

C. Student processing of questioning to be used with top story of three level thinking questions for short stories or novels

D. Students develop original questions

E. Student thinking log

VI. October 30-November 10, 1995

A. Introduce skill of determining cause/effect

B. Cause/effect lesson (Appendix J)

C. Student processing of determining cause/effect to be used with short stories or novels to demonstrate how and why things happen

D. Student thinking log

E. Student rubric

VII. November 13-December 1, 1995

A. Introduce skill of sequencing

B. Sequencing lesson (Appendix K)

C. Student processing of sequencing to be used with short stories, novels, or grammar to put things or events in order

D. Introduce skill of problem-solving

E. Problem-solving lesson (Appendix L)

F. Student processing of problem-solving to be used with characters of a short story or novel to define the problem and find solutions

G. Student thinking log

H. Student rubric

VIII. December 4-December 15, 1995

A. Introduce skill of inferring

B. Inferring lesson (Appendix M)

C. Student processing of inferring to be used with short stories, novels, or poetry to draw

a possible consequence, conclusion, or implication from a set of facts or premises

D. Student thinking log

IX. December 18-December 22, 1995

A. Give post-assessment inventory

B. Give student rubric for self-assessment

Methods of Assessment

In order to assess the effects of the intervention, tests covering the content and identified skills for language arts will be developed. In addition, pre-intervention and post-intervention inventories will be used as part of the assessment process. A scoring rubric will be developed and student thinking logs will be kept throughout the intervention period.

Chapter 4

PROJECT RESULTS

Historical Description of Intervention

The objective of this project was to improve higher order thinking skills in language arts. To facilitate students in the processes of fostering higher order thinking, the researchers implemented a series of learning activities that address higher order thinking.

The researchers instructed the students in higher order thinking skills during the researchers' language arts classes. The instruction was scheduled twice a week for a 30-40 minute time period, lasting from the first day of school through December 22, 1995. Observations of students led the researchers to conclude that the students' skill development proceeded ahead of schedule. The skills chosen for the intervention included: brainstorming, predicting, compare/contrast, questioning, cause/effect, sequencing, problem-solving, and inferring. Sample materials devoted to each of these skills can be found in Appendices D-M. In order to reinforce the skills, the researchers integrated lessons from various sources into the language arts curriculum. The researchers introduced and modelled each skill, and provided

opportunities for students to practice those skills during a two week time period.

Student rubrics and teacher-constructed inventories assessed the ability of the students to utilize higher order thinking skills. A sample student rubric can be found in Appendix C. Samples of the teacher-constructed inventories can be found in Appendix A and Appendix B. In order to assess the effects of the intervention, the researchers developed tests covering the content and identified skills for language arts. The researchers kept journals and the students utilized thinking logs to process the skills during the intervention.

Presentation and Analysis of Results

In order to assess the effects of the lessons used to improve higher order thinking skills in language arts, the researchers developed a post-assessment inventory (Appendix B) and a student rubric (Appendix C). These forms were given to 19 fourth grade and 28 seventh grade students.

The inventory attempted to assess the level of higher order thinking skills in the students. The researchers chose an imaginative situation using questions based on higher order thinking skills to extract more elaborate responses other than yes/no answers. Student behaviors demonstrated flexibility in thinking, ingenuity, originality, and insight.

In the two grades, 47 students were administered the inventory and rubric. A summary of the students' performance on the generated inventory is presented in table three.

Table 3

Intervention Standards of Student Performance

The results of the inventory indicate that of the questions students completed, nearly 90 percent of the students utilized adequate or exemplary thinking skills as compared to 50 percent utilization before the intervention was implemented. Prior to the intervention, approximately 25 percent of the students were evaluated as utilizing inadequate thinking skills. Subsequently, after completing the intervention, ten percent of the students were evaluated as utilizing inadequate thinking skills. A further analysis of the inventory suggests

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students were best at describing existing conditions and speculating about future plans. The most difficulty occurred in the use of conjecture.

Table four is a summary of the results of the student rubric administered as a self-assessment of higher order thinking skills. Students completed the same rubric before and after the intervention.

Table 4

Student Self-assessment Results

The results suggest that previous to the intervention 51 percent of the self-reporting students were comfortable in their use of higher order thinking skills as compared to 61 percent upon the completion of the intervention. This indicates that ten percent more students have the insight to measure thinking skills, have the ability to recognize thinking skills, and have the confidence to implement thinking skills. The discrepancy that the researchers found to exist between student self-reporting

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and the researchers' external observations indicating that 80 percent of students sustain inappropriate levels of higher order thinking skills and demonstrate a lack of awareness of higher order thinking skills was reversed upon completion of the intervention. Following the intervention, 80 percent of students demonstrated appropriate levels of higher order thinking skills and sustained an awareness of the existence of higher order thinking skills. Analyzing further, nearly 14 percent more of the students were aware that problems may have more than one correct solution.

Data analyzed in tables three and four suggest that students showed improvement in employing higher order thinking skills subsequent to the intervention. Ninety percent of the students feel that they have some concept of the skills needed for higher order thinking and that they have the confidence to implement those skills as compared to 53 percent prior to the intervention. Students' perspectives of their own thinking skills show a slight discrepancy between researchers' expectations and students' perceptions of their skill level, but researcher observation shows a high utilization of higher order thinking.

Some student behaviors the researchers observed include: flexibility in thinking showing that student problem-solving was done in a variety of ways, persistence by the students to keep on working toward a solution, and

a sense of wonderment in which the students decided the activities were fun and that they were surprised that they could actually do the activities.

Conclusions and Recommendations

The data indicate a marked improvement in the skills presented including: brainstorming, predicting, compare/contrast, questioning, cause/effect, sequencing, problem-solving, and inferring. The researchers believe that the teaching of higher order thinking skills is an important component of the educational process. Students must receive direct instruction in higher order thinking skills.

The skills learned during the lessons taught on higher order thinking transferred to the students' daily work. Students did become proficient in attacking a problem and working through the problem to a conclusion. They were more aware of the need for a definite plan to solve problems. Ideas became clear and yes/no answers disappeared. Students elaborated on answers and delved deeper into characteristics leaving surface answers behind. Students became aware of the fact that other students attacked the problem differently than they did. Learning difficult concepts became fun, making the complicated concepts solvable. Students demonstrated persistence showing significant gains in attacking difficult problems. Visualization improved and awareness of the thought

processes involved helped the students think the problem through to a conclusion.

The researchers recommend that higher order thinking skills be incorporated into lesson plans on a particular day of the week to be determined by the make-up of the group. Thinking sessions should not be haphazardly taught, but should have a definite place in the curriculum.

Graphic organizers played a large role in organization of the thought processes. Utilization of completed graphic organizers during discussions generated a great deal of creative and critical thinking.

Skills must be reviewed to make the students aware that they are utilizing them in their subject matter. Processing of each skill must take place so the students initiate the incorporation of thinking in their daily lives. They must become aware of the skills they are using so as to transfer them to problems in real-life situations. Pointing out the name of the skill as it occurs in daily lessons is helpful in creating connections between the lessons taught and the application of lessons being learned.

Because of the skills taught during the intervention, students showed a marked improvement in higher order thinking skills. They developed persistence, flexibility in thinking, insight, and metacognition demonstrating a high level of critical and creative thinking.

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Appendices

Appendix A

Pre-assessment Inventory Name_____

Imagine you are a styrofoam cup in a landfill.

1. Describe your surroundings, including what you see, feel, and smell.

2. How were you used before you came to the landfill?

3. How does it feel to be pushed around by a bulldozer?

4. Do you ever get bored just laying around? Speculate on what you could do for excitement.

5. Predict what your plans are for the future.

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Appendix B

Post-assessment Inventory Name_____

Imagine you are a piece of seaweed in the ocean.

1. Describe your surroundings, including what you see, feel, and hear.

2. How does it feel to be pushed around by the sea creatures?

3. Do you ever get bored just waving back and forth? Speculate on what you could do for excitement.

4. If you were uprooted by a deep sea diver, then what would happen?

5. Predict what your plans are for the future.

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Appendix C

Student Rubric

Name_____

1. I express ideas clearly.

None of the time	Some of the time	Most of the time	All of the time

2. I suggest ideas not thought of before.

None of the time	Some of the time	Most of the time	All of the time

3. I know how to begin to solve the problem.

None of the time	Some of the time	Most of the time	All of the time

4. I think things through to a conclusion.

None of the time	Some of the time	Most of the time	All of the time

5. I accept that there is more than one right answer to the problem.

None of the time	Some of the time	Most of the time	All of the time

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Louder Than a Clap of Thunder!

Louder than a clap of thunder,
louder than an eagle screams,
louder than a dragon blunders,
or a dozen football teams,
louder than a four-alarmer,
or a rushing waterfall,
louder than a knight in armor
jumping from a ten-foot wall.

Louder than an earthquake rumbles,
louder than a tidal wave,
louder than an ogre grumbles
as he stumbles through his cave,
louder than stampeding cattle,
louder than a cannon roars,
louder than a giant's rattle,
that's how loud my father SNORES!

1. Read the poem, "Louder Than a Clap of Thunder," by Jack Prelutsky. Note the wide variety of loud noises included in the poem.

2. List loud things that are not found in the poem. Brainstorm with friends for a long list of loud things.

3. Select the most unusual loud things from your list and write another verse to insert between the first and last verses of this poem.

4. Using the same idea, brainstorm for a long list of things that are:

   SOFTER THAN
   BIGGER THAN
   HAPPIER THAN
   SMALLER THAN
   ANGRIER THAN
   HUNGRIER THAN

Illus. by James Stevenson ©1984 from THE NEW KID ON THE BLOCK by Jack Prelutsky ©1984. Used with permission Greenwillow Books.

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TODAY,
I Learned For Sure !
1.
2.
3.

THE VIEW FROM THE CHERRY TREE by Willo Davis Roberts

Here is great reading for mystery fans. Below are the opening paragraphs of the first few chapters. What will you *predict* is happening??? Will happen??? To support or deny your predictions, read THE VIEW FROM THE CHERRY TREE by Willo Davis Roberts. First Aladdin Books Edition. 1987, Macmillan Publishing.

Chapter One

From his perch in the cherry tree Rob Mallory could see into the houses on either side. It was the Mallory's tree, but it was closest to Mrs. Calloway's house; right up against it, as a matter of fact, and one of the numerous causes of problems with their neighbor.

Chapter Two

Sometimes somebody spoke to him. "Rob, haven't you got a clean shirt?" or "Don't mess up the living room." but mostly they didn't notice he was around. When dinner was finally ready, he ate in silence. After dinner the rest of them went off on their own business. Rob stayed out of their way while they were leaving.

Chapter Three

He didn't know where she'd been hiding, but there was no doubt the old witch had been waiting for them . . . Rob and the cat. She pounced with a triumphant cry, and the broom crashed down on Rob's head. It scratched the side of his face, and then was lifted and brought down again and again, slashing at him, pounding, jabbing, and all the while she was yelling and screaming at him.

Chapter Four

It wasn't difficult to arrange, really. He knew they used catsup for blood, in the movies. He'd seen a show about how they did it. There was plenty of catsup in the kitchen. That was about all the props he needed.

Rob's life is in danger but no one believes him!

Chapter Five

He was getting better at spitting cherry pits. He got a few of them onto Mrs. Calloway's windowsill. Of course he cheated, moving a little further along the big branch than usual. But it was worth it.

Chapter Six

Reluctantly, he made his way toward the small group beside the neighboring house. One of the officers, Riley, looked up and saw him.

"This the boy who saw it happen?"

"Yes, this is Rob. He was sitting in the tree . . . he often sits up there. He called us right away, but it was too late. By the time we got her down she was dead."

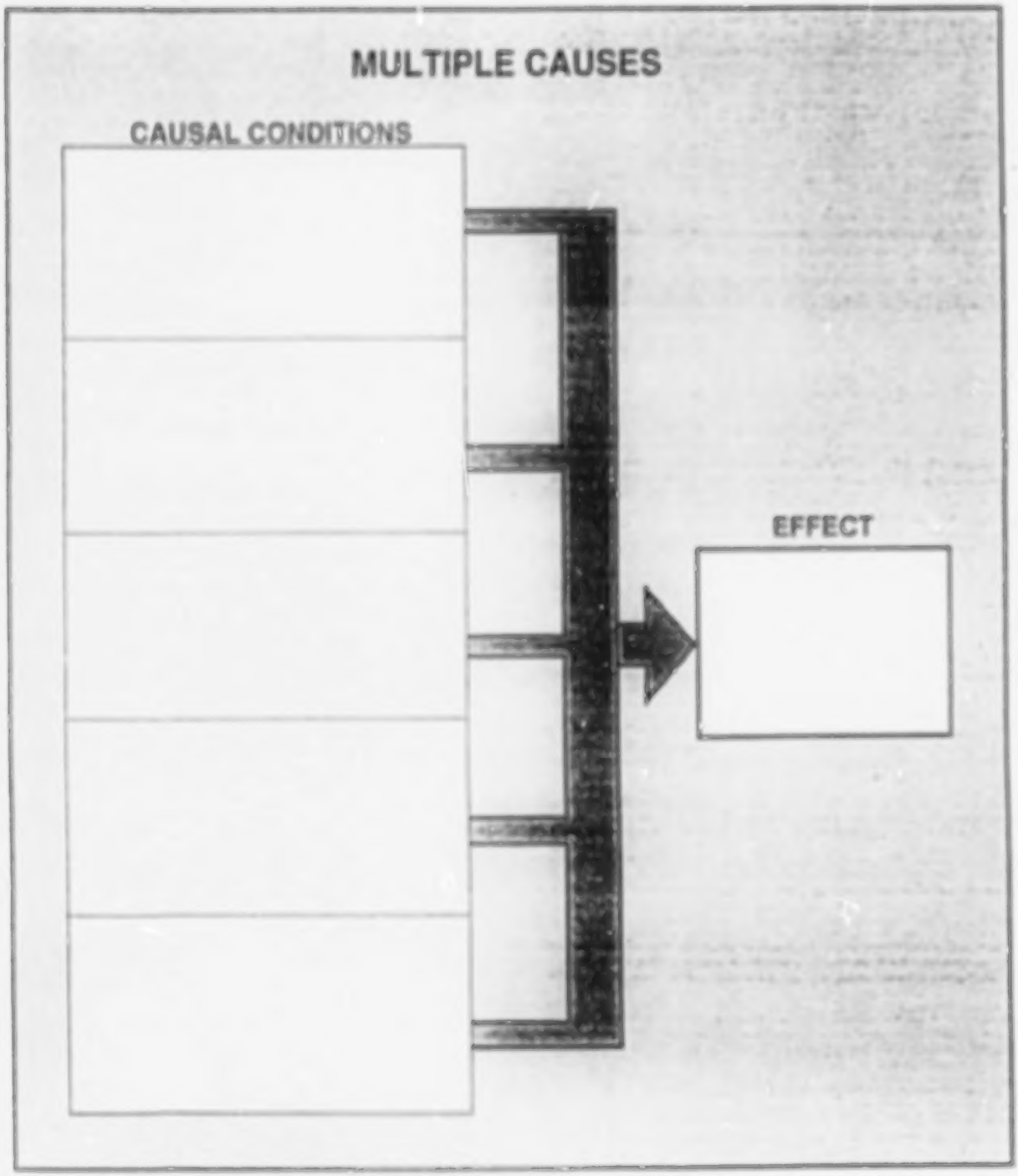
Levine, G., & Polette, N. (1987). The abc's of reading thinking and literacy 7-12. MO: Gateway.

Swartz, R.J., & Parks, S. (1994). Infusing the teaching of critical and creative thinking into elementary instruction: A lesson design handbook. CA: Critical Thinking Press and Software.

Appendix H - Sample Venn Diagram

What are some advantages and disadvantages of living on an island?

Johnson, N.L. (1990). Questioning makes the difference. United States: Creative Learning Consultants.



Swartz, R.J., & Parks, S. (1994). Infusing the teaching of critical and creative thinking into elementary instruction: A lesson design handbook. CA: Critical Thinking Press and Software.

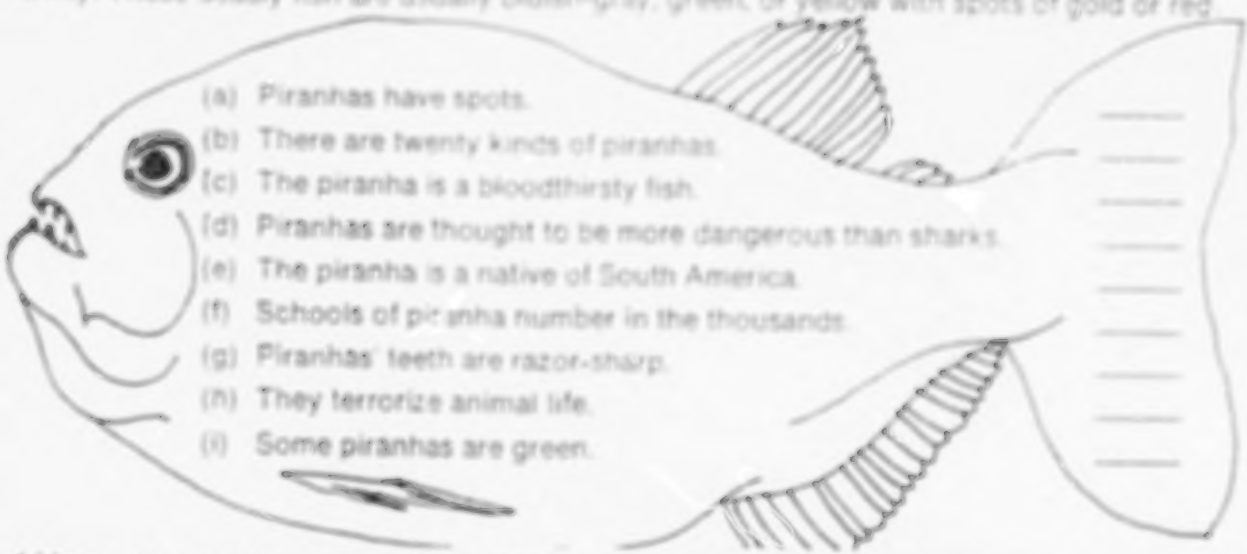
Lesson 4: Which Comes First?

Exercise A: Read the sentences and number them in the correct order.

_____ The first thing he had to do was to take a written test.
_____ Hugh successfully completed all requirements for a driver's license.
_____ Hugh went to the state drivers' license bureau.
_____ Hugh was able to drive a car by himself.
_____ He carefully studied the information in the booklet.
_____ After a week he returned to the license bureau for testing.
_____ He had to pay a fee for his license.
_____ He picked up a book of instructions telling him how to obtain a driver's license.
_____ After taking the written test, a state trooper accompanied him on the road test.
_____ With a licensed driver, he practiced driving his parents' car.

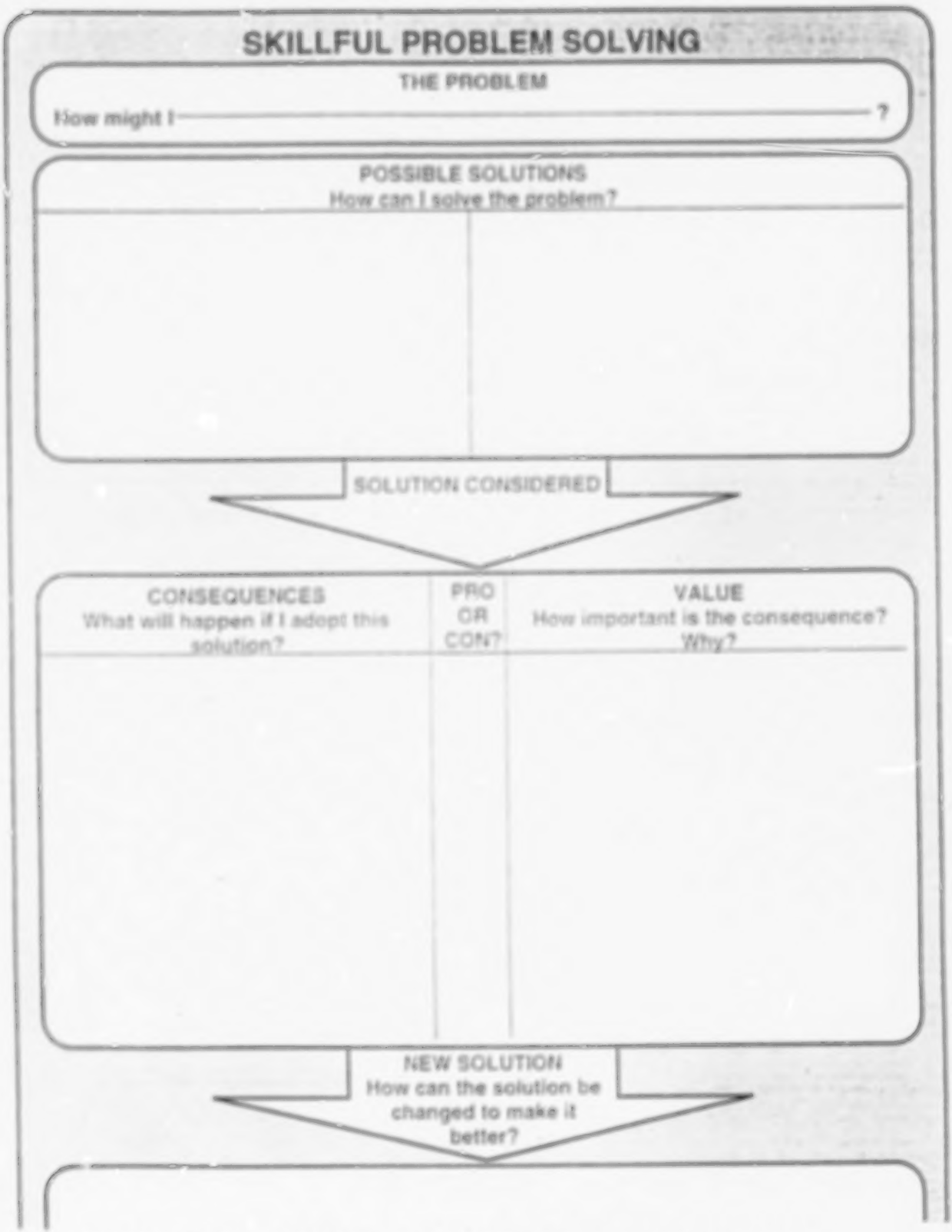
Exercise B: After reading the paragraph, put the following statements in the order in which they appear in the passage.

Piranhas, bloodthirsty fish, are sometimes called Caribes. They are native to South America and are found in the Amazon River. Piranhas can be as small as four inches, but can grow to be eighteen inches in length. Schools of piranhas, sometimes numbering in the thousands, inhabit the Amazon River, terrorizing human and animal life. A number of scientists feel that piranhas are more dangerous than sharks. Indeed, it is possible for them to rip the flesh off the skeleton of a human being or animal in a matter of minutes. Their razor-sharp teeth are lethal weapons. There are roughly twenty different kinds of piranhas, the best known of which belong to the characin family. These deadly fish are usually bluish-gray, green, or yellow with spots of gold or red.



(a) Piranhas have spots. _____
(b) There are twenty kinds of piranhas. _____
(c) The piranha is a bloodthirsty fish. _____
(d) Piranhas are thought to be more dangerous than sharks. _____
(e) The piranha is a native of South America. _____
(f) Schools of piranha number in the thousands. _____
(g) Piranhas' teeth are razor-sharp. _____
(h) They terrorize animal life. _____
(i) Some piranhas are green. _____

Allen, Y., & Witscher, M. (1982). Sequencing and following directions. MO: McDonald.



Swartz, R.J., & Parks, S. (1994). Infusing the teaching of critical and creative thinking into elementary instruction: A lesson design handbook. CA: Critical Thinking Press and Software.

BACKGROUND When reading a mystery or watching a TV thriller, many sugge and clues are given. The reader or viewer must read betwe lines, put clues together and infer what is meant. This skill of inferring is also one of the frequently tested in reading exams.

THINKING SKILL: INFERRING

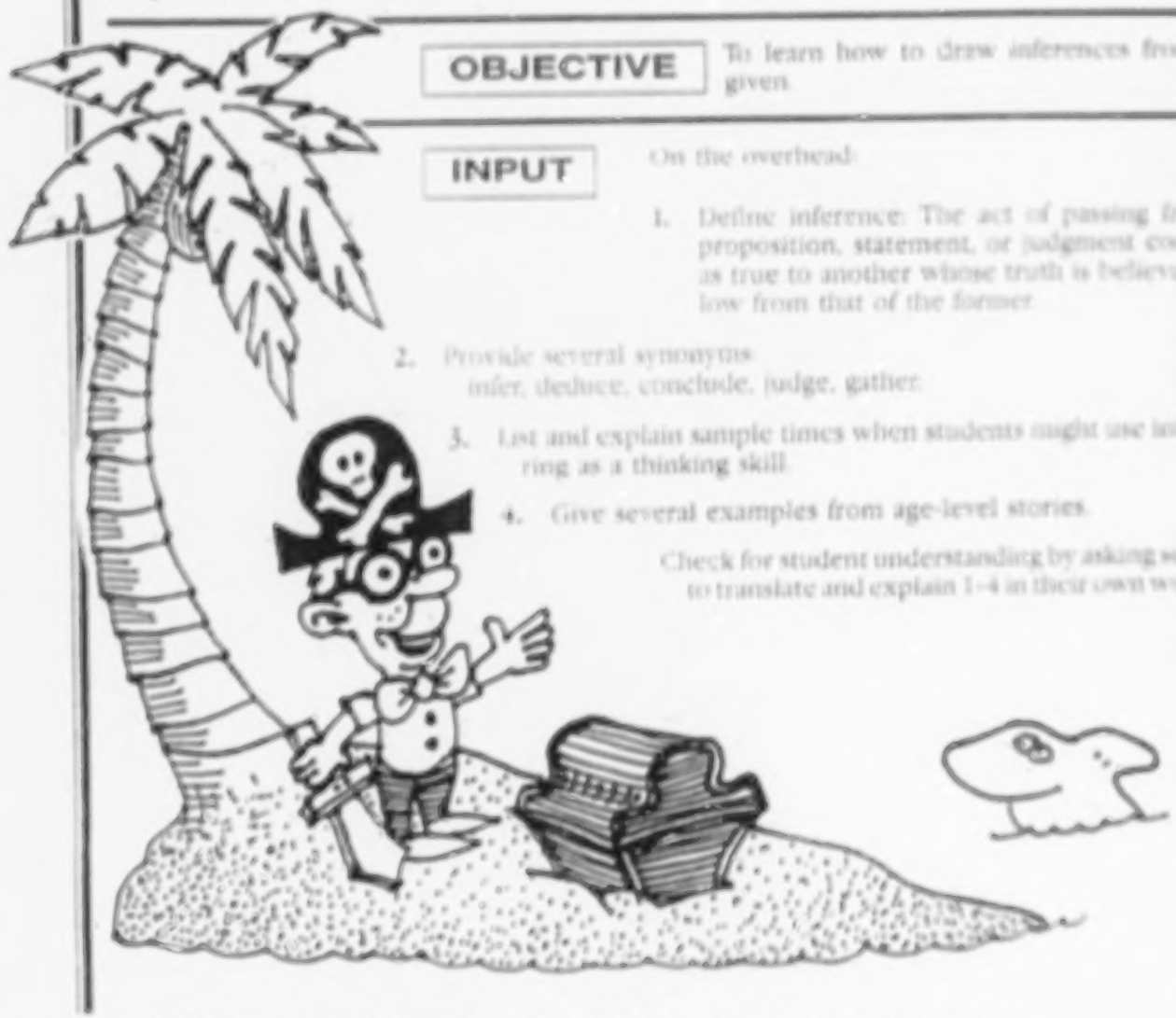
FOCUS ACTIVITY Ask students to tell you all they know about pirates. If you insist on the DOVE (p. 62) Guidelines so they do down each others ideas. List all the answers on the board or overhead. If they have no backg assign research topics from the library about pirates.

OBJECTIVE To learn how to draw inferences from given

INPUT On the overhead:

1. Define inference: The act of passing fro proposition, statement, or judgment con as true to another whose truth is believed low from that of the former.
2. Provide several synonyms: infer, deduce, conclude, judge, gather.
3. List and explain sample times when students might use infe ring as a thinking skill.
4. Give several examples from age-level stories.

Check for student understanding by asking stu to translate and explain 1-4 in their own wor



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PIRATE'S MAP

ACTIVITY

Instructions

Arrange students into groups of three.

Give each group the following clues:

A. The partially torn map

B. A label-free bottle

C. A torn monopoly dollar

Ask one student to record. Invite each group to generate possible connections among the three objects. What do the objects tell us might have happened?

After five minutes, give out the second piece of paper.

Tell the trios to use this last clue to add to or modify their guesses on what might have occurred.

After the trios have the final pieces, instruct them to write a news story that includes a description of who, when, what, where, why and how it happened.

METACOGNITIVE DISCUSSION

Share the stories.

After each story, ask the following:

A. What clues did you use in deciding what happened? Which did you ignore? Why?

B. In arranging the clues, how accurate were the inferences? Explain.

C. Did this trio leave out any important information?

D. When making inferences, what would you place on a list of do's/don'ts. (List these.)

CLOSURE

In your LOG, use the lists of do's and don'ts to evaluate how well you drew inferences from the clues *and* what traps you will have to avoid.

OR

In your LOG, complete the stem, "about inferences I learned..."